Preliminary Study to Explore the Pharmacotherapeutic Efficacy of Ethanolic Extract of Banana Flower

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***Abstract*—The banana plant is a perennial herb that blooms. Nearly every component of this crop including the flowers, stems, leaves and fruits, has nutritional, medicinal and therapeutic qualities. In general, banana blossoms are angiosperm plants' reproductive organs, particularly those with colourful or ostentatious elements. A cluster of folded leaves on a fully grown stalk extends into an oval-shaped, dark purple bud known as a blossom or flower. Banana blossoms have two main parts.Exterior sheath-like substance varying red and purple colours are called as Bract. Interior tiny tubular-toothed white blossoms arranged besides floral stacks are called Florets.**

Hence, our present study utilized flowers and assessed the phytochemical screening, quantification, antioxidant activity through ABTS and ORAC, cytotoxicity through MTT assay, and antiaging property through inhibition of tyrosinase, elastase and collagenase to explore the pharmacotherapeutic efficacy of ethanolic extract of banana flower. From the results it can be concluded that banana flower extract has high amount of antioxidant activity which in turn attribute to their antiaging property. Therefore, we suggest to perform further studies focusing on other characteristic markers of banana flower extract to understand the pharmacological potential. Further studies could help understand and utilization of affordable, widely available and consumable banana flower extract in pharmacological application.

***Index Terms*—Banana blossoms, Pharmacotherapeutic efficacy, Anti-aging property. Corresponding Author: Thiripurasundari B**

I. INTRODUCTION

A fruit that is consumed most frequently throughout the world due to its taste, flavor and health advantages is the banana. Generally speaking, it developed in South East Asia and India (tropical humid environments). It is currently grown in tropical regions around the equator, 30 degrees north and 30 degrees south, all over the world (Singh, 2017).

The banana plant is a perennial herb that blooms. Nearly every component of this crop including the flowers, stems, leaves and fruits, has nutritional, medicinal and therapeutic qualities. It is an important consumable plant crop of sustenance and farmers can ensure year-round production and income (Meghwal et al., 2024). The extensive value of the portions of crops that belong to or are connected to the Musaceae family includes flowers, stems, fruits, leaves and so on. There are 42 species and 2 genera (Ensete and Musa) in the family Musaceae; 10 species are in Ensete and 32 are in Musa. Currently, 1200 banana species and variants are categorized (Awedem et al., 2015).

A musa plant has several different parts including roots, fruits, flowers and others. Each component has a unique purpose, nutritional worth and bioactive properties (Deb et al., 2018).

One of the earliest crops cultivated in emerging nations like India is the banana. Their nutritional and pharmacological profiles are good. Every part of the banana plant has a different medical purpose. It is the antioxidant powerhouse that includes phytonutrients, phenolics and polyphenols. The minerals potassium, iron, zinc, phosphorus and the vitamins C, B2, B6, B5, E and A are abundant in banana flowers. Bananas and its components also include significant concentrations of phytochemicals such as quercetin, lectin, alkaloids, dopamine, flavonoids and tannins. Because of its many uses and potential, bananas and their by-

products- leaves, fibers, peels and fruits are used in both the food and non-food industries to make a variety of goods.

In India, Banana blossom is usually considered as vegetable, also has potential to be regarded as a functional food due to its high nutrient content (excellent source of fiber, good source of protein, vitamin A, C and E, minerals like phosphorus, potassium bleeding, facilitates lactation, helps in overcoming diabetes, helpful in weight loss and good for gastrointestinal health). In general, banana blossoms are angiosperm plants' reproductive organs, particularly those with colourful or ostentatious elements. A cluster of folded leaves on a fully grown stalk extends into an oval-shaped, dark purple bud known as a blossom or flower. Banana blossoms have two main parts:

Exterior sheath-like substance varying red and purple colours are called as Bract.

Interior tiny tubular- toothed white blossoms arranged besides floral stacks are called Florets.

In several Asian countries, such as India, banana blossoms are a staple in various dishes. Banana blossoms are utilized by people in South and Southeast Asia in a variety of dishes, including curries, soups, fried meals and raw or steaming dips. The blooms' flavor is similar to that of artichokes. Still, the flower parts were not explored extensive. Hence, our present study utilized flowers and assessed the phytochemical screening, quantification, antioxidant activity through ABTS and ORAC, cytotoxicity through MTT assay, and antiaging property through inhibition of tyrosinase, elastase and collagenase.

FIGURE 1 : BANANA BLOSSOM

II. MATERIALS AND METHODS

PREPARATION OF BANANA FLOWER EXTRACT: Banana flower was procured from the local area near Egmore, Chennai. It were separately dried at room temperature in uncovered recipients, grounded to a fine powder and dried again. Extraction process, infusion, a type of maceration was utilized for the extract preparation. After grinding into fine PRELIMINARY PHYTOCHEMICAL SCREENING powder, they were placed in a clean container. Then the extraction solvent 50% ethanol is then poured on top of the sample material, soaked, and kept for a short period of time (24h) to extract the bioactive constituents that are readily soluble. Then, the samples were filtered with grade 1 Whatman paper. 2% extracts were prepared using 50% ethanol; stored and utilized for further analysis.

S.NO	EXPERIMENTS	OBSERVATIONS
1	TEST FOR ALKALOIDS WAGNER‟S TEST A few drops of Wagner‟s reagent are added to few ml of plant extract along the sides of test tube.	A reddish- Brown precipitate
2	TEST FOR AMINO ACID NINHYDRIN TEST Two drops of ninhydrin solution (10 mg of ninhydrin in 200 ml of acetone) are added to 2 ml of aqueous filtrate.	Appearance of purple colour
3	TEST FOR CARBOHYDRATE MOLISCH' S TEST To 2 ml of plant sample extract, two drops Molish' s reagent are added. The mixture is shaken well and few drops of concentrated sulphuric acid is added slowly along the sides of test tube BENEDICT' S TEST To 0.5 ml of filtrate, 0.5 ml of Benedict‟s reagent is added. The mixture is heated on a boiling water bath for 2 minutes FEHLING'S TEST 1mL each of Fehling's solution A & B + 1mL filtrate + boiled in water bath	A violet ring A characteristic red/yellow/green colored precipitate A red precipitate
4	TEST FOR PHENOLIC COMPOUNDS FERRIC CHLORIDE TEST The extract (50 mg) is dissolved in 5 ml of distilled water. To this few drops of neutral 5% ferric chloride solution are added	A dark green colour
5	TEST FOR FLAVONOIDS ALKALINE REAGENT TEST An aqueous solution of the extract is treated with 10% ammonium hydroxide solution. ACID TEST Plant extract + conc. HCl	Yellow fluorescence Red color
6	TEST FOR STEROLS SALKOWSKI'S TEST Filtrate + few drops of conc. H_2SO_4 (Shaken well and allowed to stand) (Ayoola *et al*., 2008).	Red colour (in lower layer)
7	TEST FOR PROTEINS The extract (100 mg) is dissolved in 10 ml of distilled water and filtered through Whatmann No. 1 filter paper and the filtrate is subjected to test for proteins BIURET TEST 2 ml of filtrate is treated with 1 drop of 2% copper sulphate solution. To this 1 ml of ethanol (95%) is added, followed by excess of potassium hydroxide pellets	Pink colour ethanolic layer
8	TEST FOR GUM AND MUCILAGES The extract (100 mg) is dissolved in 10 ml of distilled water and to this 2 ml of absolute alcohol is added with constant stirring.	White or cloudy precipitate
9	TEST FOR DITERPENES Plant extract is dissolved in distilled water + 3-4 drops of copper acetate solution	Emerald green colour

10	TEST FOR TANNINS 10% NaOH TEST 0.4mL plant extract + 4mL 10% NaOH + shaken well	Formation of emulsion
11	TEST FOR QUINONES CONC. HCL TEST Plant extract + conc. HCl	A green colour
12	TEST FOR GLYCOSIDES For 50 mg of extract is hydrolysed with concentrated hydrochloric acid for 2 hours on a water bath, filtered and the hydrolysate is subjected to the following tests. BORNTRAGER'S TEST To 2 ml of filtered hydrolysate, 3 ml of choloroform is added and shaken, choloroform layer is separated and 10% ammonia solution is added to it.	Pink colour

PHYTOCHEMICALS QUANTIFICATION

QUANTIFICATION OF ALKALOIDS

The extract was dissolved in 2 N of Hydrochloric acid (HCl) and then filtered. 1 ml of test extract solutions was transferred to separating funnel and added 5 ml of phosphate buffer pH 4.7 and 5 ml of bromocresol green (BCG) solution. The mixture was shaken and complex formed was extracted with 5 ml of chloroform. Chloroform layer was collected in 10 ml of volumetric flask and volume was made up to mark with chloroform. Absorbance was taken at 470 nm against blank. The alkaloid content was expressed in terms of mg of atrophine equivalents/ g of extract.

QUANTIFICATION OF TANNINS

The tannins were determined by Folin-Ciocalteu method. About 0.1 ml of the sample extract was added to a volumetric flask (10 ml) containing 7.5 ml of distilled water and 0.5 ml of Folin-Ciocalteu phenol reagent, 1 ml of 35% sodium carbonate solution and diluted to 10 ml with distilled water. The mixture was shaken well and kept at room temperature for 30 min. A set of reference standard solutions of gallic acid (20, 40, 60, 80, 100 µg/ ml) were prepared as described earlier. Absorbance for test and standard solutions were measured against the blank at 720 nm with an UV/ Visible spectrophotometer. The estimation of the tannin content was carried out in triplicate. The tannin content was expressed in terms of mg of gallic acid equivalents/ g of extract.

QUANTIFICATION OF TOTAL PHENOLS

The total phenolic contents in the extracts were measured using Folin-Ciocalteu reagent method (Makkar *et al*., 1993). Aqueous extract of 0.02 ml, 0.05 ml and 0.1 ml were transferred into test tubes and the volume was made up to 0.5 ml with distilled water. To this solution, 0.25 ml of Folin- Ciocalteu reagent (1N) and then 1.25 ml of 20% sodium carbonate was added, and the tubes were vortexed thoroughly. Absorbance was recorded at wavelength of 550 nm using UV- visible spectrophotometer after 40 minutes. The concentration of total phenolic compounds in the extract was calculated as Gallic acid equivalent (GAE) from standard curve. The total phenolic content was expressed as GAE/g of extract.

QUANTIFICATION OF TOTAL FLAVONOIDS

Total flavonoid content of the extracts was determined according to method of Nabavi *et al*. (2008). The aqueous plant extract (0.5 ml) was mixed with distilled water (2 ml) and subsequently with 5% $NaNO_2$ solution (0.15 ml). After 6 mins of incubation, 10% AlCl3 solution (0.15 ml) was added and then allowed to stand for 6 min, followed by addition of 1M NaOH solution (2 ml) to the mixture. Then, distilled water was added to the sample to make up the volume to 5 ml and the mixture was thoroughly mixed and allowed to stand for another 15 min. The mixture s absorbance was determined at 510 nm using UV-Visible spectrophotometer. The test was performed in triplicate and the flavonoid content was expressed as mg of quercetin equivalent per g of extract (mg QE/g).

ASSAY OF ANTIOXIDANT ACTIVITY

ABTS RADICAL SCAVENGING ASSAY

Free radical scavenging activity of plant samples was determined by ABTS radical cation decolorization

assay. ABTS·+ cation radical was produced by the reaction between 7 mM ABTS in water and 2.45 mM potassium persulfate (1:1), stored in the dark at room temperature for 12-16 h before use. ABTS·+ solution was then diluted with methanol to obtain an absorbance of 0.700 at 734 nm. After the addition of 5 µl of plant extract to 3.995 ml of diluted ABTS·+ solution, the absorbance was measured at 30 min after the initial mixing. An appropriate solvent blank was run in each assay. All the measurements were carried out at least three times. Percent inhibition of absorbance at 734 nm was calculated using the formula, ABTS·+ scavenging effect (%) = ((AB–AA)/ AB)×100 (2), where, AB is absorbance of ABTS radical + methanol; AA is absorbance of ABTS radical + sample extract/standard. Vitamin C was used as standard substance.

EXFOLIATING EFFECT ASSAY

Tyrosinase activity was determined by spectrophotometry, with minor modifications. First, 80 µL of 0.1 M potassium phosphate buffer (pH 6.6), 20 µL of sample dissolved in dimethyl sulfoxide at the concentrations needed (final concentrations 100–500 µg/mL), and 50 µL of L-tyrosine buffer (1.5 mM) solutions were mixed. Then, 50 µL of mushroom tyrosinase solution (200 unit/mL in phosphate buffer) was added to each mixture, which was then incubated at 25 °C for 15 min. The absorbance of the mixture was observed at 450 nm using a 96-well reader. Kojic acid used as the standard. The percent inhibition of tyrosinase was calculated as follows:

% Inhibition of tyrosinase =((A−B)−(C−D)/(A−B))× 100%

where A is the absorbance of the reaction mixture of the enzyme but without test samples, B is the absorbance of the buffer solution without test samples and enzyme, C is the absorbance of the test samples and enzyme, and D is the absorbance of the test sample but without enzyme.

TOTAL ANTIOXIDANT ACTIVITY BY OXYGEN RADICAL ABSORBANCE CAPACITY (ORAC-FL)

Antioxidant capacity was determined using the ORAC-fluorescence methodology (ORAC-FL). The analyses were performed using a 96-well white polystyrene plate reader (EnSpire multimode PerkinElmer, Waltham, MA, USA). The reaction was carried out in phosphate buffer of 75 mM (pH 7.4). The sample was homogenized and incubated at 37 °C for 5 min with 150 µL of fluorescein solution (40 nM, final concentration). Then, 25 µL of 2,2′-azobis(2-methylpropionamidine) dihydrochloride (Sigma-Aldrich 97%, St Louis, MO, USA) 18 mmol L^{-1} was added; the fluorescence was registered with an excitation wavelength of 485/20 nm and an emission filter of 528/20 nm at a constant temperature of 37 °C in a Synergy HT multi-detection microplate reader (Bio-Tek Instruments, Winooski, VT, USA) every minute for 2 h. The ORAC values were expressed as mmol Trolox equivalents per gram of dry sample (mmol TE/g DW). A Trolox calibration curve was used with a concentration range between 3 and 20 µmol L^{-1}.

MTT ASSAY

MTT Assay on SiHa Cells was performing using the following procedure. 96-well plate was seeded with 1 × 104 cells/mL and incubated at 37°C for 24hrs. After incubation, the medium was changed and cells were treated with different concentrations of test sample and incubated for 24hrs. Once the cells had been treated with the samples for 24 h, 10 µL of a 5mg/mL of MTT solution was added to each well, and the mixture was incubated for 4 hours at 37 °C. After removing the supernatant, 100 µL of DMSO was applied to each well in order to dissolve the formazan. Using a microplate reader, the formazan crystals were measured at 595 nm.

ELASTASE ASSAY

The assay employed was based on methods from the literature. This assay was performed in 0.2 mM Tris-HCL buffer (pH 8.0). Porcine pancreatic elastase (PE – E.C. 3.4.21.36), was dissolved to make a 3.33 mg/mL stock solution in sterile water. The substrate N-Succinyl-Ala-Ala-Ala-*p*-nitroanilide (AAAPVN) was dissolved in buffer at 1.6 mM. The test extracts were incubated with the enzyme for 15 minutes before adding substrate to begin the reaction. The final reaction mixture (250 µL total volume) contained buffer, 0.8 mM AAAPVN, 1 µg/mL PE and 25 µg test extract. EGCG (250 µM or 0.114 mg/mL) was used as a positive control. Negative controls were performed using water. Absorbance values between 381 and 402 nm (following pre-screen scans) were measured immediately following addition of the substrate and

then continuously for 20 minutes using a Cary 50 Microplate Reader in Nunc 96 well microtitre plates.
The percentage inhibition for both of these assays is calculated by:
Enzyme inhibition activity (%) = $[(OD_{control} - OD_{sample}) / OD_{control}] X 100$

COLLAGENASE ASSAY
Prior to screening in all assays, spectra for all extracts were recorded on a Cary 300 UV-visible spectrophotometer to check for interference and shifts in the lambda max.
The assay employed was based on spectrophotometric methods reported in the literature with some modifications for use in a microplate reader. The assay was performed in 50 mM Tricine buffer (pH 7.5 with 400 mM NaCl and 10 mM $CaCl_2$). Collagenase from *Clostridium histolyticum* (ChC – EC.3.4.23.3) was dissolved in buffer for use at an initial concentration of 0.8 units/mL according to the supplier's activity data. The synthetic substrate *N*-[3-(2-furyl) acryloyl]-Leu-Gly-Pro-Ala (FALGPA) was dissolved in Tricine buffer to 2 mM. Plant extracts were incubated with the enzyme in buffer for 15 minutes before adding substrate to start the reaction. The final reaction mixture (150 µL total volume) contained Tricine buffer, 0.8 mM FALGPA, 0.1 units ChC and 25 µg test extracts. Negative controls were performed with water. Absorbance at 335 nm was measured immediately after adding substrate and then continuously for 20 minutes using a Cary 50 Microplate Reader in Nunc 96 well microtitre plates. EGCG, 250 µM (0.114 mg/mL) was used as a positive control.

STATISTICAL ANALYSIS
In this study, all the experiments were carried out in three independent biological replicates, and data were reported as mean ± standard deviation for each set of conditions. Statistical significance of the data was tested through one - way analysis of variance (ANOVA) using least significant difference with $p<0.05$, $p<0.01$, $p<0.001$.

III. RESULTS

TABLE 1: PRELIMINARY PHYTOCHEMICAL SCREENING OF ETHANOLIC EXTRACT OF BANANA FLOWER

S.NO	EXPERIMENTS	INFERENCES
1	Test for alkaloids	PRESENT
2	Test for amino acid	PRESENT
3	Test for carbohydrates - Molisch's Test	PRESENT
4	Test for carbohydrates - Benedict's Test	PRESENT
5	Test for carbohydrates - Fehling's Test	PRESENT
6	Test for phenols	PRESENT
7	Test for flavonoids - Con.HCl	PRESENT
8	Test for sterols	PRESENT
9	Test for proteins	ABSENT
10	Test for Diterpenoids	ABSENT
11	Test for Gum and mucilages	PRESENT
12	Test for Tannins	PRESENT
13	Test for Quinones	ABSENT
14	Test for Glycosides	ABSENT

Table 1 depicts the presence of alkaloids, amino acid, carbohydrates, phenols, flavonoids, sterols, gums & mucilages, and tannins.

FIGURE 1. QUANTIFICATION OF PHYTOCHEMICALS IN ETHANOLIC EXTRACT OF BANANA FLOWER

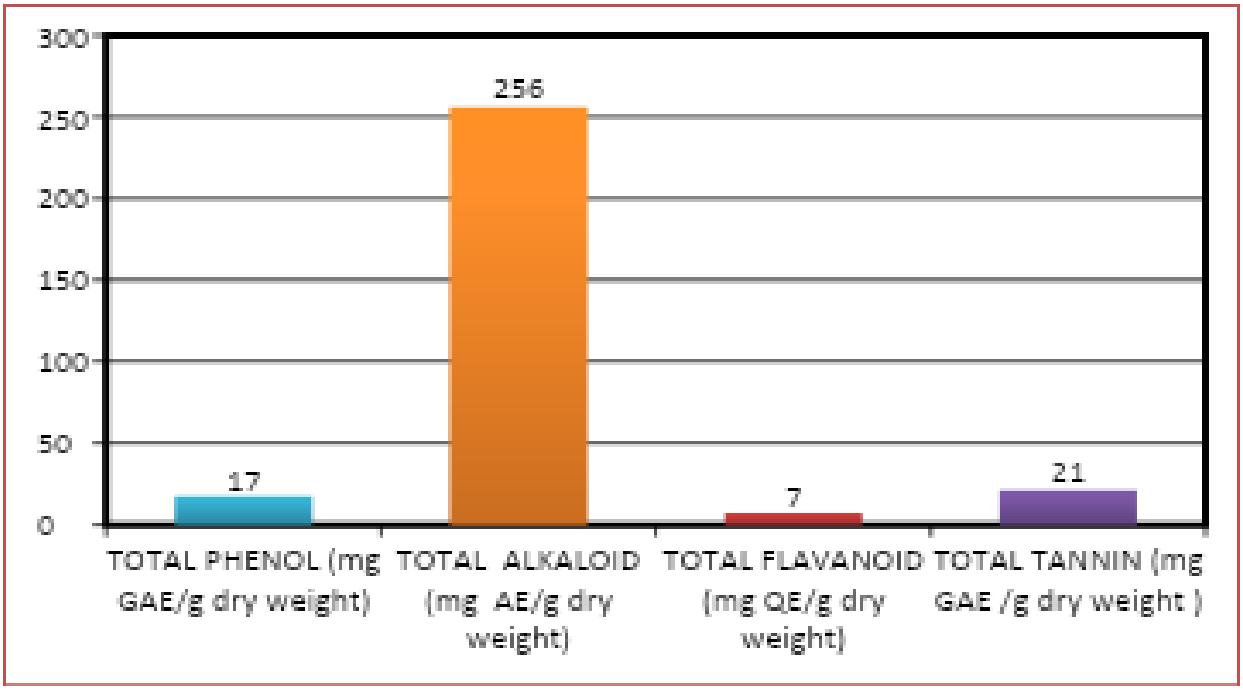

Figure 1 depicts the varying concentration of alkaloids, tannins, flavonoids and phenols in ethanolic extract of elephant foot yam. It shows the increased concentration of alkaloid and tannins compared to phenols and flavonoids.

FIGURE 2: ANTI-OXIDANT ACTIVITY OF ETHANOLIC EXTRACT BANANA FLOWER. (N=5)
2,2′-AZINO-BIS-3-ETHYLBENZTHIAZOLINE-6-SULPHONATE INHIBITION ASSAY

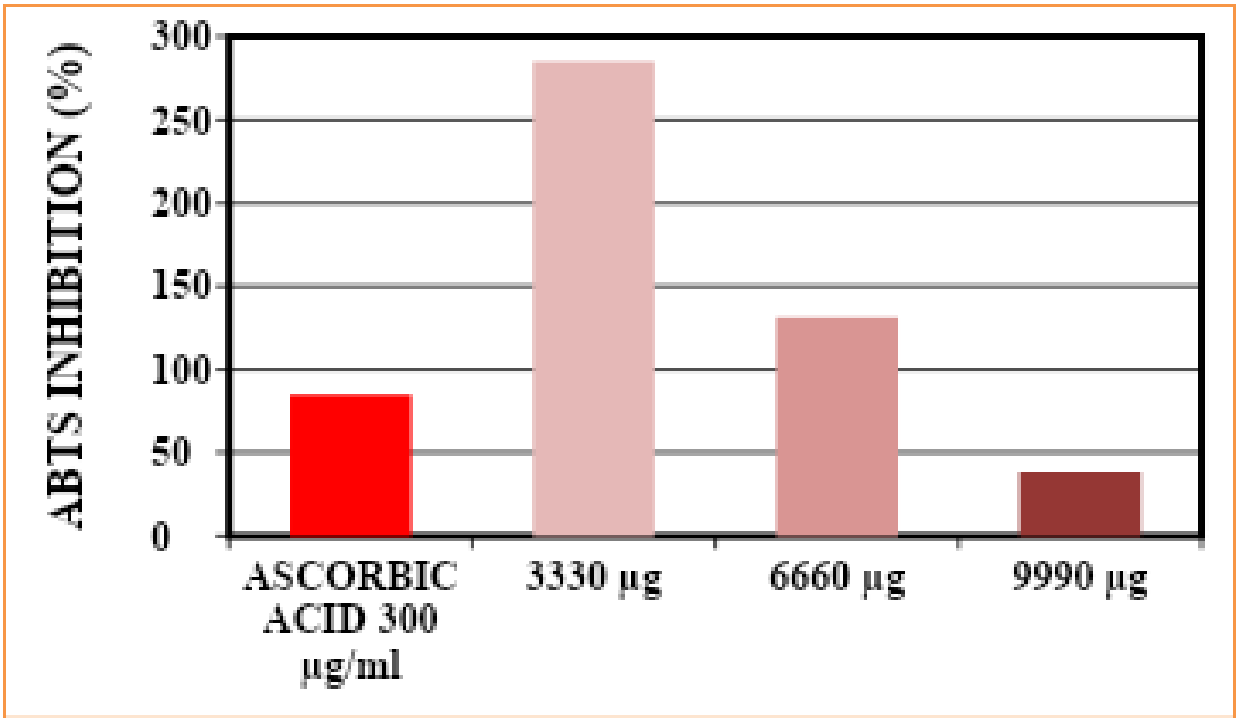

Figure 2 reveals the gradual decrease in ABTS inhibition activity on increasing the concentration for banana flower.

FIGURE 3: MTT ASSAY OF ETHANOLIC EXTRACT OF BANANA FLOWER

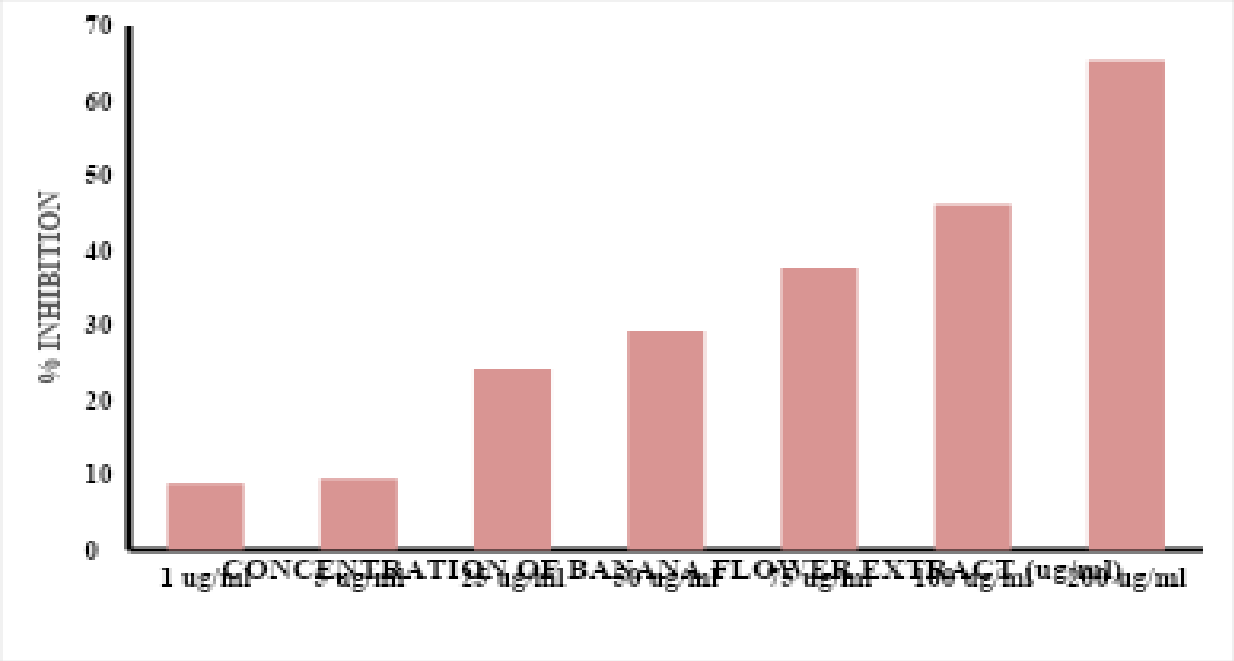

Figure 3 depicts the MTT assay which reveals that SiHa cells showed gradual decrease in cell viability on increasing the concentration from 1µg to 200µg/ml

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FIGURE 4: OXYGEN RADICAL ABSORBANCE CAPACITY OF ETHANOLIC EXTRACT OF BANANA FLOWER

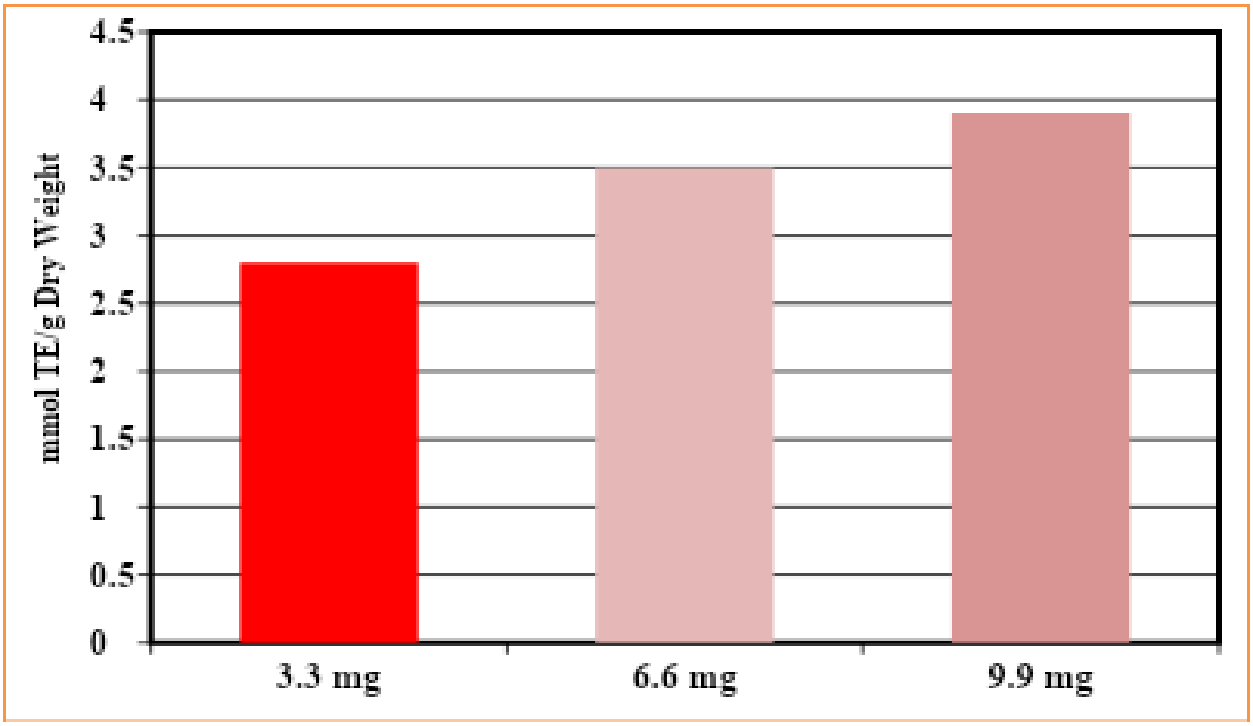

Figure 4 depicts the ORAC assay which reveals the gradual increase in oxygen radical absorbance on increasing the concentration of banana flower extract.

FIGURE 5: EXFOLIATING EFFECT / ANTITYROSINASE EFFECT OF ETHANOLIC EXTRACT OF BANANA FLOWER

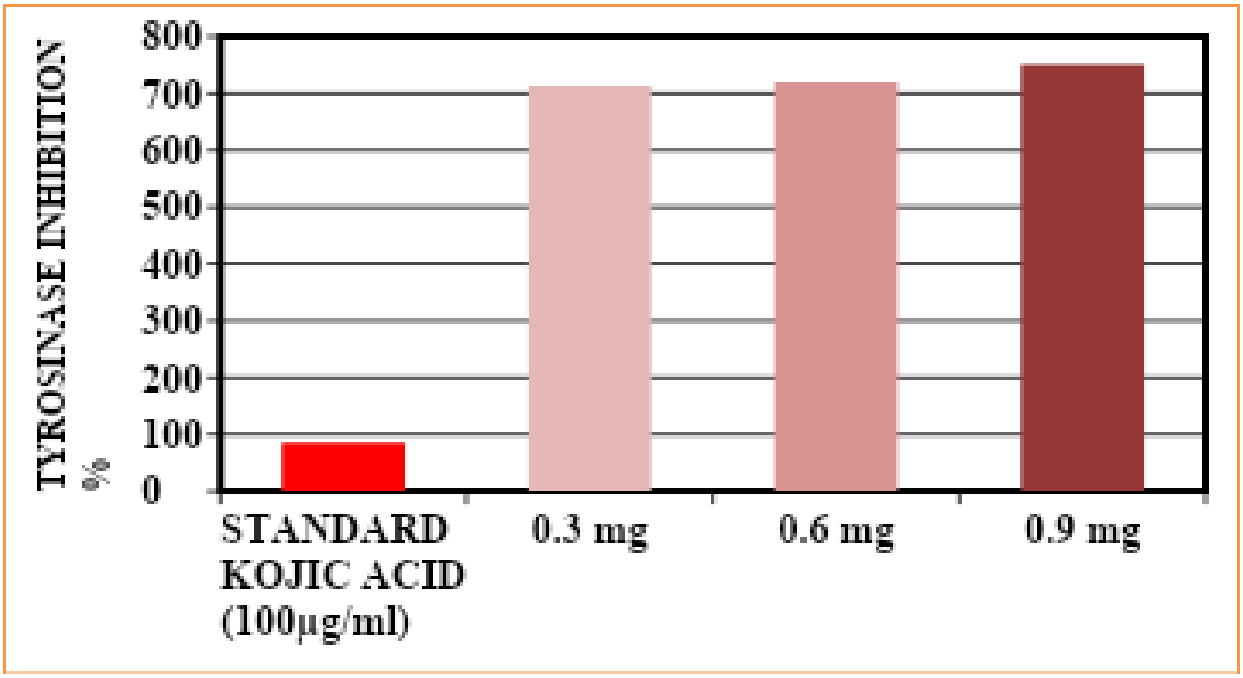

Figure 5 depicts the exfoliating effect assessed through tyrosinase inhibition activity. It shows the significantly increased tyrosinase inhibition on increasing the concentration for banana flower. Kojic acid used as the standard.

FIGURE 6: ANTI-ELASTASE ACTIVITY OF ETHANOLIC EXTRACT OF BANANA FLOWER

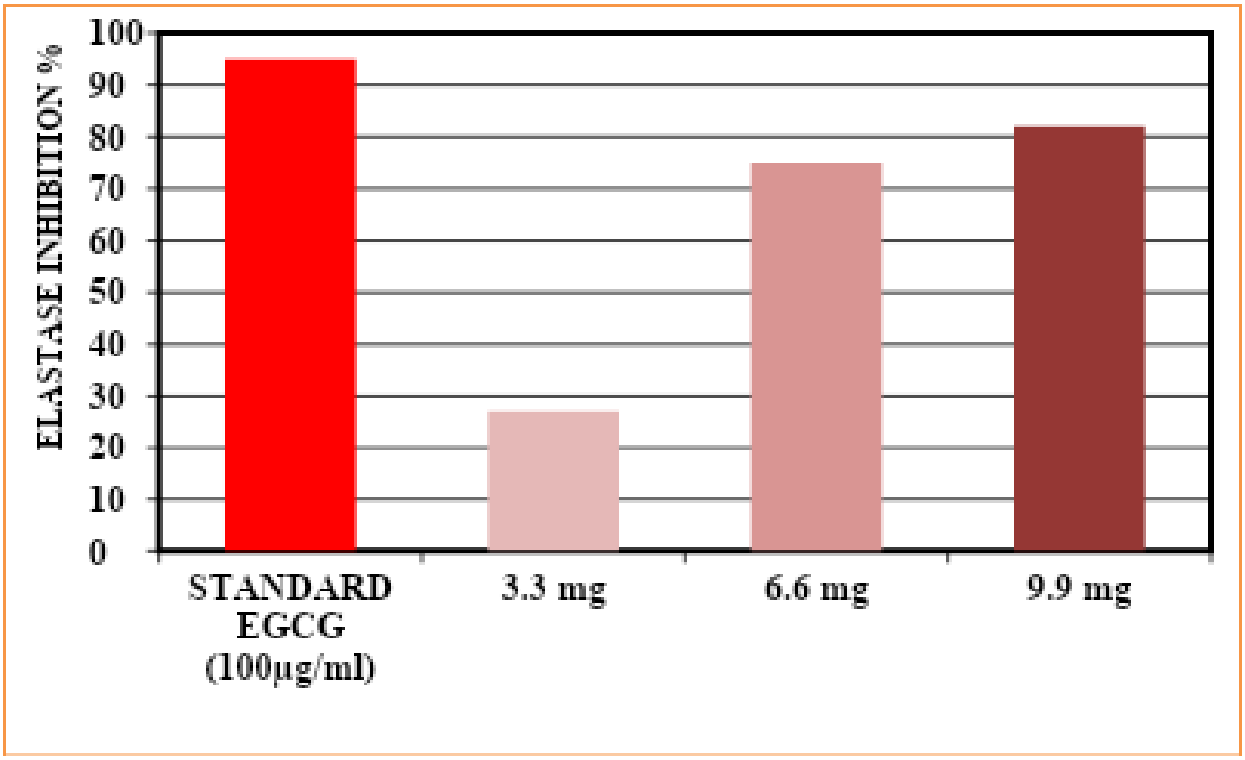

Figure 6 depicts the anti-elastase effect assessed through elastase inhibition assay. It shows the significantly increased elastase inhibition on increasing the concentration for banana flower. EGCG used as the standard.

FIGURE 7: ANTI-COLLAGENASE ACTIVITY OF ETHANOLIC EXTRACT OF BANANA FLOWER

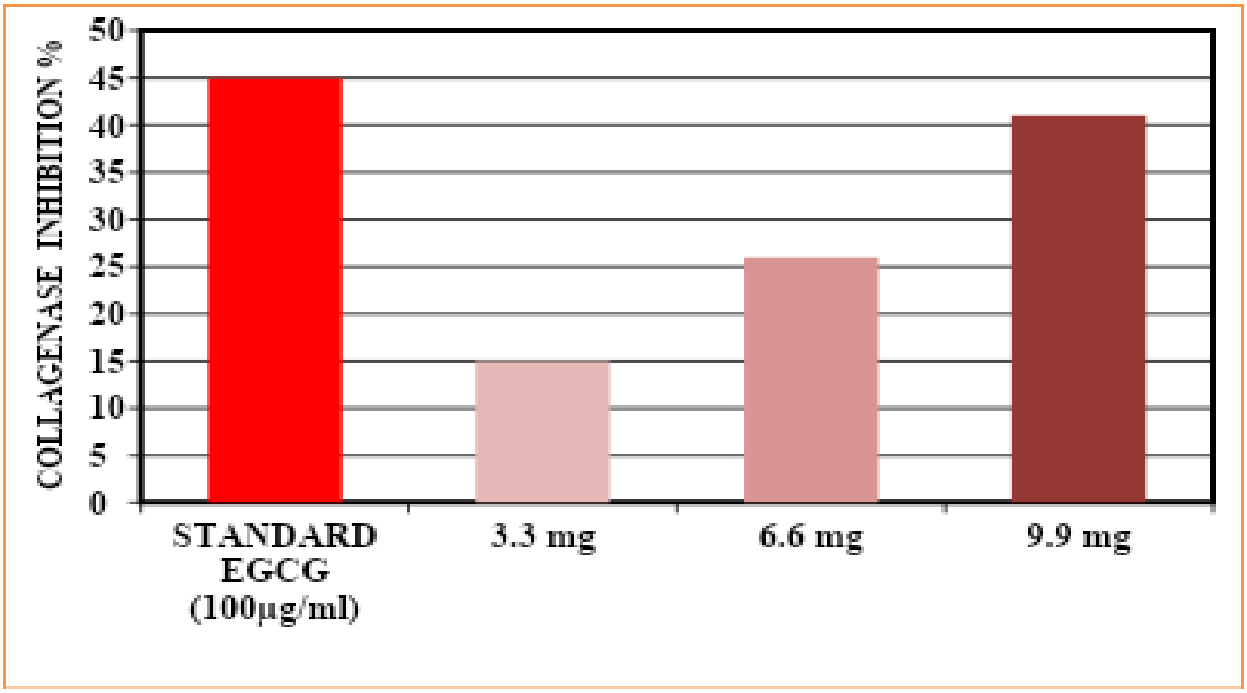

Figure 7 depicts the anti-collagenase effect assessed through collagenase inhibition assay. It shows the significantly increased collagenase inhibition on increasing the concentration for banana flower. EGCG used as the standard.

IV. DISCUSSION

By-product of fruits and vegetables has received high importance in recent years as a newer source of dietary fibre (DF) and varies according to the plant species, its genotype and even within the cultivar of the same species (Rodica *et al*., 2010). The composition of fibre, its organizational structure, physicochemical and surface properties, and associated bioactive (oligosaccharides and bound phenolics) compounds are mainly responsible for the physiological benefits of DF (Macagnana *et al*., 2016). Besides, polyphenols associated with DF is also responsible for beneficial effects, especially in the prevention and management of chronic and degenerative diseases (Aruna *et al*., 2017). Approximately 50% of total dietary antioxidant is comprised of these phenolics associated with plant polysaccharides (Macagnana *et al*., 2016).

In the present investigation, banana flowers were utilized to assess their pharmacotherapeutic value. Preliminary investigation of phytochemicals screening and quantification presented in Table 1 and Figure 1. Table 1 depicts the presence of alkaloids, amino acid, carbohydrates, phenols, flavonoids, sterols, gums & mucilages, and tannins. In the context of quantification of phytochemicals, Figure 1 depicts the varying concentration of alkaloids, tannins, flavonoids and phenols in ethanolic extract of elephant foot yam. It shows the increased concentration of alkaloid and tannins compared to phenols and flavonoids. Consistent to our study results, Sumathy *et al*., (2011), reported that tannins, phenols, flavonoids, glycosides, saponins and steroids are present in the methanol extract of banana blossoms.

Further, the phytochemicals associated antioxidant activity was ascertained and presented in Figure 2, which reveals the gradual decrease in ABTS inhibition activity on increasing the concentration for banana flower. Figure 4 depicts the ORAC assay which reveals the gradual increase in oxygen radical absorbance on increasing the concentration of banana flower extract. It is suggesting that this may be attributed to the presence of phytochemicals such as alkaloids, phenols, flavonoids and tannins. Free radical scavenging is one of the know mechanism by which antioxidant inhibits lipid peroxidation. The free radical scavenging activity has been widely used for screening antioxidants from fruit and vegetable juice or extract. It is well known that the banana is a source of phenols, alkaloids, tannins and flavonoids.

Generally, fruits rich in phytochemicals have been related to potential health benefits for consumers. Phytochemicals are also called as secondary metabolites, which are antioxidant compounds with the ability to protect against oxidative damage caused by reactive oxygen species related to human diseases, such as degenerative diseases, cardiovascular diseases, chronic inflammation, or cancer.

In addition, cytotoxic characteristics of banana flower extract was analysed through MTT assay. Figure 3 depicts the MTT assay which reveals that SiHa cells showed gradual decrease in cell viability on increasing the concentration from 1µg to 200µg/ml. Similarly, dose dependent cytotoxic effect of amberlite XAD 7 purified anthocyanins extract from Begonia malabarica and Begonia rex-cultorum 'Baby' Rainbow plants were obtained by MTT assay (Madanakumar and Kumarasamy, 2018). It may be attributed to the presence of phytochemical which include anthocyanins. Anthocyanins, as effective chemopreventive agents, are strong inducers of apoptosis in premalignant and malignant cells. Previous in vitro studies showed that pure anthocyanins and anthocyanin-rich extracts from fruits and vegetables have exhibited antiproliferative activity towards multiple cancer cell types (Rodrigo *et al*., 2006). Many other studies demonstrated that anthocyanin-rich extracts from berries and grapes and several pure anthocyanins and anthocyanidins have exhibited pro-apoptotic effects in multiple cell types (Olsson *et al*., 2004). Anthocyanins induce apoptosis through both intrinsic (mitochondrial) and extrinsic (FAS) pathways (Reddivari *et al*., 2007).

In addition, antiaging effect was analyzed, and presented in Figure 5, 6 and 7; revealed from inhibition of tyrosinase, elastase and collagenase. It shows the significantly increased inhibition of tyrosinase, elastase and collagenase on increasing the concentration for banana flower. Studies reported that medicinal plants possessing inhibitory actions on elastase and collagenase, which degrade elastin and collagen fibres, and antioxidant efficacies might play significant roles in the deceleration of the skin ageing process and could potentially be developed for cosmetic purposes. Our result findings suggest that ethanolic extract banana flower could potentially be beneficial as a component in cosmetic and pharmaceutical formulations with antioxidant and anti-aging properties revealed from significant inhibitory potential in inhibiting tyrosinase, elastase and collagenase.

It may be attributed to the presence of polyphenol, anthocyanin in banana flower extract. Anthocyanins are glycosylated polyphenolic compounds synthesized in the cytoplasm and stored in vacuoles (Chanoca *et al*. 2015). Although anthocyanins are well known as water-soluble flavonoid pigments with colors ranging from orange and red to purple and blue in flowers, seeds, fruits, and vegetation, they are important in attracting pollinators, seed dispersal by promoting fruit consumption, as well as plant protection against biotic and abiotic stresses owing to their antioxidant properties (Liu *et al*. 2018). There are numerous papers regarding the health benefits of anthocyanins because of their antioxidant, anti-inflammatory, and anticancer effects (Alappat and Alappat 2020), indicating that they are integrally involved interactions between humans and nature. It is also proved that anthocyanins exhibit potential antiaging property which fits our study results.

This research work has investigated phytochemical screening, quantification of phytochemicals, antioxidant activity, cytotoxic ability, and antiaging property of ethanolic extract of banana flower. The analysis of ethanolic extract of banana flower revealed their considerable antioxidant properties and the associated antiaging activity. From the results it can be concluded that banana flower extract has high amount of antioxidant activity which in turn attribute to their antiaging property. These findings confirmed that the banana blossom may have use in food ingredient, pharmaceutical or utilized for functional foods with potential health-benefit effects.

V. SUMMARY AND CONCLUSIONS

Overall, our results indicate that the banana flower extract found to be more free radical scavenging revealed from antioxidant activity (ABTS and ORAC). A dose-dependent inhibition of ABTS inhibition and ORAC was observed with banana flower extract. In addition, cytotoxic property or antiproliferative effect was also observed, depicted from MTT assay. Finally, antiaging property analysis suggests that banana flower extract exhibit a potential antiaging property revealed from inhibition of key aging markers such as elastase, collagenase and tyrosinase. It also suggests that antiaging property was

enhanced on increasing the concentration of the banana flower extract. Therefore, we suggest to perform further studies focusing on other characteristic markers of banana flower extract to understand the pharmacological potential. Further studies could help understand and utilization of affordable, widely available and consumable banana flower extract in pharmacological application.